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Report to the Chairman, Subcommittee on Oversight and Investigations, Committee on Energy and Commerce, House of Representatives

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# AIR POLLUTION

# Issues Inhibiting Marine Vessel Emission Controls Are Still Unresolved

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GAO

**United States**
**General Accounting Office**
**Washington, D.C. 20548**

**Resources, Community, and**
**Economic Development Division**

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October 7, 1988

The Honorable John D. Dingell
Chairman, Subcommittee on Oversight
and Investigations
Committee on Energy and Commerce
House of Representatives

Dear Mr. Chairman:

At your request we reviewed the efforts of federal and state agencies to control marine vessel emissions. This report discusses the efforts of (1) the Environmental Protection Agency (EPA) and the states to control hydrocarbon emission from marine vessel loadings and (2) the Department of Transportation's Maritime Administration and Coast Guard to address the safety and interstate commerce issues associated with vessel emission controls.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of this letter. At that time, we will send copies of the report to appropriate congressional committees; the Administrator, EPA; the Secretary of Transportation; and the Director, Office of Management and Budget. We will also make copies available to others upon request.

Major contributors to this report are listed in appendix I.

Sincerely yours,

Hugh J. Wessinger

Hugh J. Wessinger
Senior Associate Director

# Executive Summary

## Purpose

Nearly 20 years after the Clean Air Act was passed, many areas in the United States still have not brought ozone, commonly known as smog, down to acceptable levels. In port cities, ozone levels could be reduced by capturing ozone-producing vapors given off during the loading of petroleum products into tankers and barges, but industry and states have long been concerned about the safety and cost of recovery systems and the effect of differing state requirements on interstate commerce. The Chairman, Subcommittee on Oversight and Investigations, House Committee on Energy and Commerce, therefore asked GAO to examine federal and state

- actions to control marine vessel emissions and
- efforts to address vessel safety and interstate commerce issues.

## Background

Under the Clean Air Act, the Environmental Protection Agency (EPA) is responsible for setting national air quality standards for certain pollutants considered harmful to public health. The states, in turn, are responsible for regulating the sources of those pollutants to make sure that air quality standards are met. States must have an EPA-approved state implementation plan, or SIP, that lays out a strategy for attaining federal standards.

Unlike other air pollutants, ozone is not emitted directly but is produced by the reaction of hydrocarbons and nitrogen oxides in the presence of sunlight. Regulatory authorities therefore seek to meet the ozone standard by controlling hydrocarbon emissions. To date, their efforts have concentrated on controlling emissions from motor vehicles and industrial plants, the largest sources of hydrocarbon emissions.

A substantial portion of marine vessel hydrocarbon emissions can be given off during the loading of tankers and barges with crude oil and gasoline, as they displace the hydrocarbon vapors in the cargo tanks. According to a National Research Council report released in 1988, vessel loading emissions account for about 0.2 percent of the hydrocarbons produced in the United States. Earlier studies by California and Texas, however, showed that vessel emissions could be much higher in certain port areas. Emissions can be reduced through vapor control systems. The use of these systems, however, can adversely affect port and vessel safety and waterborne commerce. Accordingly, the installation and operation of these systems have concerned the Coast Guard, which is responsible for maritime safety, and the Maritime Administration, which is responsible for promoting the U.S. maritime industry.

## Results in Brief

Although EPA proposed controls in the early 1970s, marine vessel emissions remain largely unregulated, in part, because industry, the Coast Guard, and the Maritime Administration raised questions about safety, cost, and effects on interstate commerce. The Coast Guard and EPA attempted to resolve some of these questions but discontinued their efforts in 1981 when EPA reduced its overall budget and the Coast Guard perceived no state interest in regulating vessel emissions. Efforts resumed in 1984, when the Coast Guard became aware of a growing state movement to regulate vessel emissions and in 1985 requested a study by the National Research Council. The Council's study assessed the safety and cost issues, finding that additional operating experience, testing, and studies were necessary. In late 1987, the Coast Guard began developing safety standards, which should allay some concerns. At about the same time, EPA proposed a national ozone strategy that outlined several ways in which EPA might provide support for the states in controlling emissions from various sources, including vessels, such as by prescribing specific control measures or by providing technical information on control systems.

## Principal Findings

### Controls Over Vessel Emissions

Although EPA and some state and local air pollution control authorities have considered regulating vessel emissions, only one—the Santa Barbara, California, Air Pollution Control District—sets limits on the level of hydrocarbon emissions that can be released during vessel loading operations.

EPA proposed vessel emission controls in 1973, when regional officials found that the Texas state implementation plan would not result in attainment of the ozone standard. At least 12 states, including those that contain most of the nation's largest ports, have also considered regulating vessel emissions. Neither EPA nor the states have implemented controls, however, in part, because of concerns about the safety and cost of vapor recovery systems and the effects on interstate commerce. Since the Coast Guard is responsible for port and vessel safety, it identified a number of potential hazards, particularly fire and explosions. Vessel operators were also concerned about the costs of vapor recovery systems and the possibility that differing requirements might restrict vessels' ability to operate in different states.

EPA now recognizes that states may find it difficult to control some emission sources, including marine vessels, without federal assistance. In November 1987, as part of a proposed national ozone strategy, EPA outlined several forms of federal support to the states, including prescribing specific control measures and providing technical information. In September 1988, EPA was evaluating public comments on its proposal.

## Safety, Cost, and Interstate Commerce Issues

Although the Coast Guard, EPA, and Maritime Administration have attempted at various times to address the safety, cost, and interstate commerce issues, none of these issues has been completely resolved. In the late 1970s, the Coast Guard undertook several projects to develop and test devices that would reduce the risk of fire and explosion. The Coast Guard also joined EPA's ongoing demonstration of vapor recovery for barges. However, the demonstration came to a halt in 1981, when EPA's budget was reduced. As a result of EPA's elimination of the demonstration and an apparent absence of state plans to regulate vessel emissions, the Coast Guard stopped further work on vapor control systems.

The Coast Guard's interest revived in 1984 when several states began to look into controlling vessel emissions. In 1985, the Coast Guard asked the National Research Council's Marine Board to assess the technical, safety, and economic impacts of vessel emission controls, particularly in the absence of uniform standards. Released in January 1988, the study found that vapor emissions could be controlled with available technology but that there had been too little experience to project conclusively the safety of planned operations. The study also concluded that while economic impacts could be substantial, more detailed study was needed to gauge their size. In the meantime, a Coast Guard advisory committee has begun to develop safety regulations for vapor recovery systems that the Coast Guard anticipates issuing in final form by 1990.

To address its concerns about the effects of state vessel emission regulation on interstate commerce, the Maritime Administration has consistently advocated giving this authority to the federal government. Along with the Coast Guard, the Maritime Administration developed a proposal in 1982 to amend the Clean Air Act to give EPA the authority to regulate marine vessel emissions and the Coast Guard the authority to establish and enforce safety standards and regulations. EPA, however, has decided to consider vessel emission controls in the context of its overall ozone strategy.

## Recommendations

In light of the ongoing Coast Guard actions to develop safety standards, as well as EPA's proposed national ozone strategy, GAO is making no recommendations at this time.

## Agency Comments

GAO discussed the matters in this report with EPA and the Coast Guard and incorporated their comments where appropriate. However, as requested, GAO did not obtain written agency comments on a draft of this report.

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**Abbreviations**

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| EPA | Environmental Protection Agency |
| GAO | General Accounting Office |
| MarAd | Maritime Administration |
| SIP | State Implementation Plan |

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# Introduction

Under the Clean Air Act, the Environmental Protection Agency (EPA) has established national air quality standards for a number of pollutants considered harmful to public health, including ozone. Ozone-producing vapors are emitted from many sources, including tankers and barges as they load petroleum products. Although marine vessels account for a relatively small percentage of total ozone-producing emissions, capturing these emissions could help bring areas with high ozone levels, particularly port cities, into compliance with the national ozone standard.

## Air Pollution Controls

The Clean Air Act established a framework for cooperative federal and state efforts to control air pollution. The act requires EPA to set national air quality standards for certain pollutants considered harmful to public health. EPA also issues national standards establishing limits for emissions from new stationary sources and major modifications of existing stationary sources of air pollution. Each state has the primary responsibility for assuring air quality within its borders and must submit a state implementation plan that details the methods necessary to attain and maintain the standards and to implement and enforce the stationary source emission limitations.

One of the pollutants regulated under the law is ozone, often referred to as smog. Ozone has been linked to reduced lung function which affects breathing and causes symptoms such as coughing and chest pain. Unlike other pollutants, ozone is not directly emitted but is formed by a reaction between hydrocarbons and nitrogen oxides in the presence of sunlight. EPA's basic strategy for controlling ozone is aimed at controlling hydrocarbon emissions.

The national standard for ozone is 0.12 parts per million parts of air. To show how they plan to meet this standard in nonattainment areas, the states must prepare and obtain EPA's approval of state implementation plans, or SIPs. These plans must identify all emission sources within each air quality control region in the state and indicate how the national standards will be implemented, maintained, and enforced. Although the original deadline for attaining the ozone standard was 1975, many areas were unable to meet it, and the deadline was extended to December 1982, with extensions possible to December 1987 for some areas. In May 1988, EPA announced that 68 areas in the country had ozone levels in excess of the national standard.

To date, control efforts have focused on the largest sources of ozone-producing emissions: motor vehicles and stationary sources, such as

industrial facilities, that produce over 100 tons of pollutants a year. However, ozone-producing emissions originate in a wide variety of other sources, such as bakeries, autobody refinishing, and marine vessels. Controlling these other sources, including marine vessels, is therefore an integral step in attaining the national ozone standard.

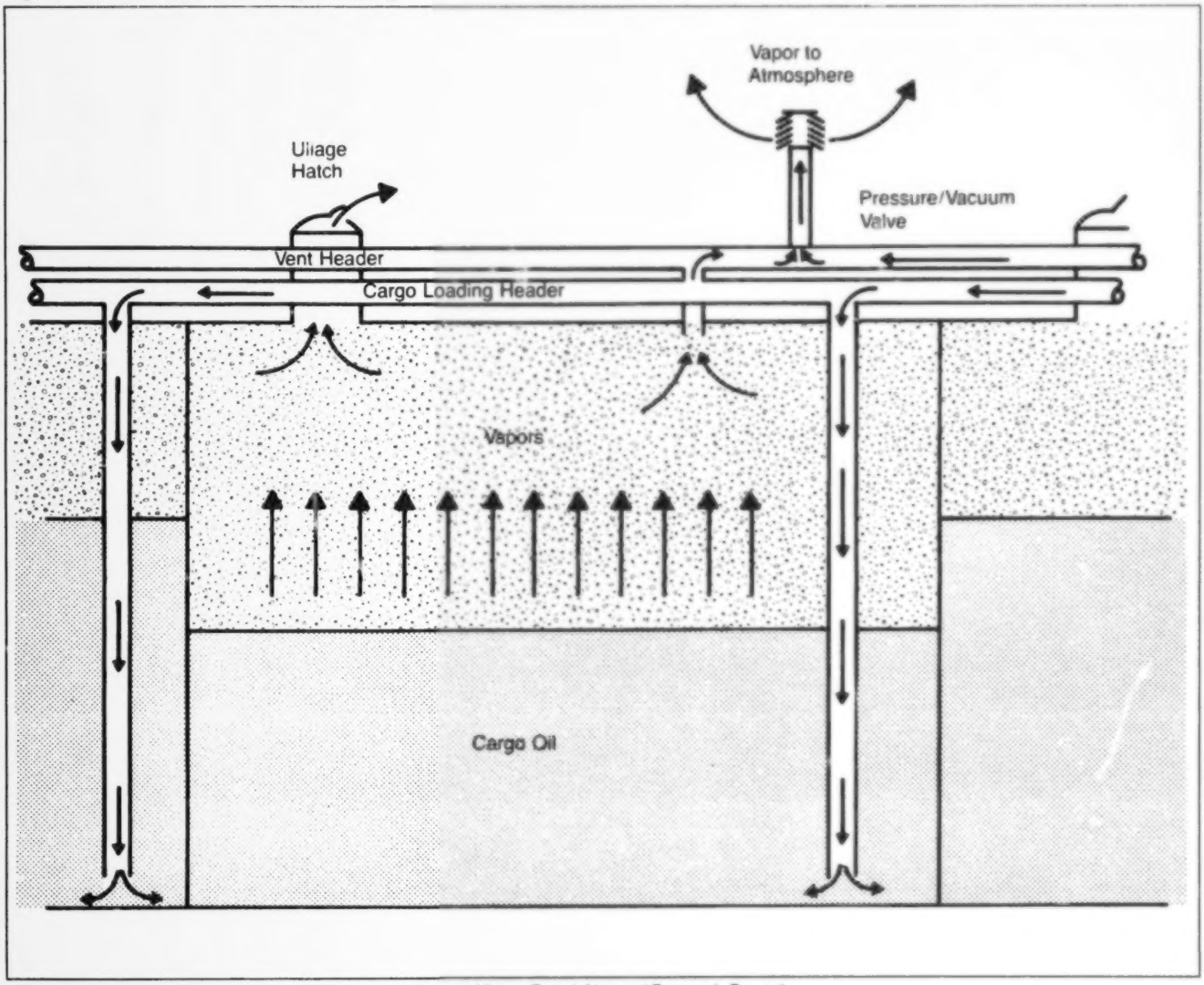
## Marine Vessel Emissions

Marine vessels emit hydrocarbons during a variety of operations. A substantial portion of these emissions can occur during the loading of tankers and barges. According to a 1988 National Research Council report, hydrocarbon emissions from marine vessel loadings may account for about 0.2 percent of the hydrocarbon emissions nationwide. Within some areas, however, this percentage is likely to be much higher. For example, a December 1986 Texas report estimates that 2 to 6 percent of hydrocarbon emissions in Texas port areas is attributable to ship and barge loading. The California Air Resources Board observed in a June 1984 report that because of the event-related nature of vessel emissions, on any given day emissions could be several times higher than the average. For example, the report stated that while the hydrocarbon emissions in the San Francisco Bay are about 15,000 pounds per average day, there may be two days on which no activity occurs and a third day during which 45,000 pounds are emitted; thus, the contribution to ozone formation would be several times the average daily contribution on those days.

Hydrocarbons are emitted during various vessel operations. Some hydrocarbons are emitted during the loading of ballast water into cargo compartments. Vapors are also emitted during "lightering," the transfer of cargo from a large vessel to a smaller one in order to enter a port, as well as cargo loading. Most vessel loading emissions occur during the loading of tankers and barges with petroleum products, particularly crude oil and gasoline. These emissions are produced when the vapors in empty cargo tanks are displaced and forced out into the surrounding atmosphere through open hatches or vents. (See fig. 1.1.) With over 30 ports in the United States each loading more than 1 million tons of crude oil and gasoline a year, emissions could be important, particularly in the 18 ports that are in areas that do not meet the national ozone standard.

Vapor recovery systems are commercially available and have been in use on vessels and at terminals that load liquified natural gas and other hazardous fluids. In the last few years, vapor recovery systems have been installed at a few facilities that load petroleum products (see ch. 2).

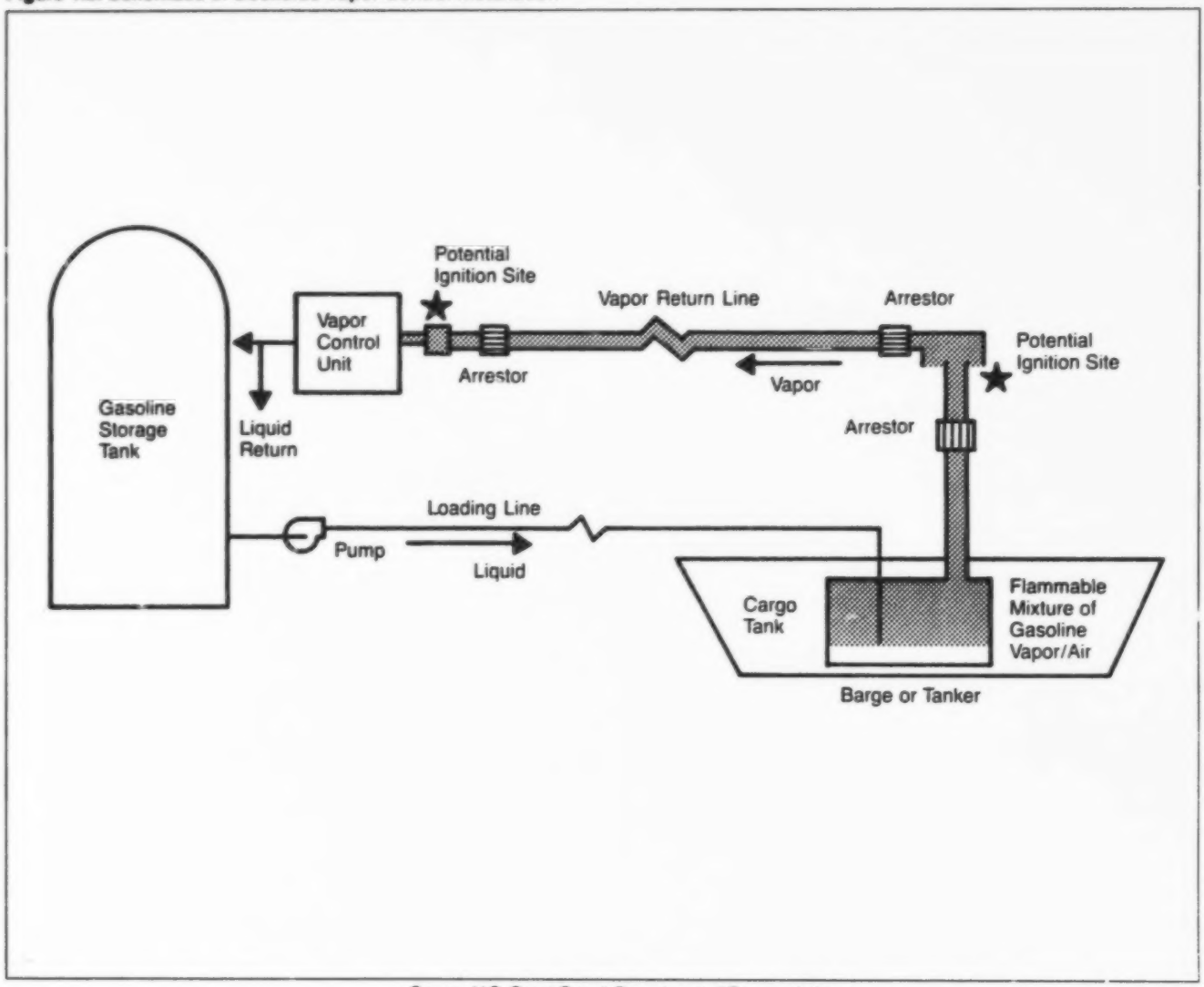
**Figure 1.1: Emissions From Cargo Loading**




Source: Marine Board, National Research Council

These systems collect the vapors before they are vented to the atmosphere and route them to a processing system where they are either recovered or burned. (See fig. 1.2.) Generally, vapor recovery systems are installed in marine terminals and connected to vessels by a pipeline.

**Figure 1.2: Schematic of Dockside Vapor Control Installation**




Source: U.S. Coast Guard, Department of Transportation

Because emission control systems can affect the safety of port facilities and marine vessels, the U.S. Coast Guard reviews the design and installation of these systems. As part of its overall responsibility for maritime safety, the Coast Guard must set design, construction, and operating

requirements for tank vessels, including vapor recovery systems, to protect against hazards to life and property. The Maritime Administration (MarAd) is also concerned with requirements imposed on marine vessels and terminals. MarAd (which, like the Coast Guard, is part of the Department of Transportation) provides financing guarantees and other types of financial assistance for ship construction. It also implements programs to develop ports and has a general responsibility to support the operation of the U.S. merchant fleet and ports and to promote waterborne commerce. MarAd is therefore concerned with any additional costs that emission controls would impose on the maritime industry and its ability to do business.

## Objectives, Scope, and Methodology

Concerned over the long-standing issues surrounding the control of marine vessel emissions, the Chairman, Subcommittee on Oversight and Investigations, House Committee on Energy and Commerce, asked us to review federal and state

- actions to control marine vessel emissions to meet the national ozone standard and
- efforts to address marine vessel safety and waterborne interstate commerce issues.

The Chairman's office also asked us to examine the extent of industry influence on the Coast Guard's efforts to address these issues, particularly the extent of industry participation in a recent National Research Council study funded by the Coast Guard.

To determine what federal, state, and local agencies have done to control marine vessel emissions, we reviewed documents and interviewed officials at Coast Guard and EPA headquarters in Washington, D.C., and at EPA's Office of Air Quality Planning and Standards in Durham, North Carolina. We then visited and obtained information from air pollution control authorities in California, New Jersey, and Texas—states that reportedly had investigated vessel emission controls in depth—and EPA regional offices responsible for these states. In addition, we contacted officials of companies that have instituted emission controls to obtain information on vapor recovery systems. Finally, we interviewed other vessel and terminal owners about their concerns with emission control systems.

Our review of efforts to address safety and commerce issues took us to Coast Guard headquarters and field offices in Houston, Texas; Long

Beach, California; and New York, New York. We also interviewed officials and reviewed records at MarAd's Washington, D.C., headquarters.

To answer questions about industry influence, we talked to officials of EPA, state, and local air pollution control agencies, and the Coast Guard to obtain their views on the validity of issues that have stood in the way of vessel emission controls. We also obtained information from representatives of eight companies and industry groups—the American Waterway Operators, the American Petroleum Institute, and the American Institute of Merchant Shipping—that had been involved in vessel emission control issues.

With regard to industry influence on the National Research Council study, we interviewed the Staff Director of the Marine Board, the office within the council responsible for the study, to determine the procedures used to select study panel members. We also reviewed internal documents concerning the panel's work.

At the conclusion of our review, which was conducted between May 1987 and July 1988, we discussed our findings with EPA and Coast Guard officials and incorporated their comments as appropriate. As requested by the Chairman, Subcommittee on Oversight and Investigations, House Committee on Energy and Commerce, we did not obtain written agency comments on a draft of this report. Our review was performed in accordance with generally accepted government auditing standards.

# Vessel Emissions Are Largely Uncontrolled

Although EPA and some states have considered controlling vessel emissions, controls generally have not been implemented because of concerns over the availability of technology to contain the emissions, the safety and cost of control systems, and their potential negative effect on waterborne commerce. EPA, the Coast Guard, MarAd, and at least two states have undertaken studies and other efforts to address these issues, but not all the issues are resolved, although current Coast Guard and EPA efforts may allay some concerns in the future.

## EPA Efforts to Control Vessel Emissions

EPA has used two approaches to regulate marine vessel emissions: (1) requiring vessel emissions controls in an implementation plan for a state, and (2) requiring states to include vessel emissions when calculating marine terminal emissions for new source review purposes. Both approaches have been the subject of lawsuits. Currently, there are no EPA-promulgated requirements for vessel emission controls to be included in SIPs. Also, EPA is now studying which vessel emissions could be attributable to a marine terminal under the Clean Air Act's "new source" review provisions.

EPA attempted to control vessel emissions under the first approach in 1973. After it found that the implementation plan submitted by the state of Texas did not provide for sufficient reductions in hydrocarbon emissions to attain the ozone standard, EPA issued a plan that included a regulation for vessel emission controls at the ports of Houston and Galveston. The state and others, including companies that would be subject to control, challenged EPA's authority to require vessel emission controls, but in August 1974, the U.S. Court of Appeals for the Fifth Circuit upheld EPA's action, finding that EPA could require a vessel emission control program.

EPA decided, however, on the basis of concerns raised by the Coast Guard, MarAd, and the maritime industry, that it needed additional information before putting its rules into effect. One concern expressed by vessel owners and operators was that technology to recover and dispose of the emissions was not yet available. Vessel and terminal operators were also concerned about the costs of implementing emission controls.

The Coast Guard, as well as several vessel operators, was concerned about safety hazards posed by vapor recovery systems, particularly fire and explosion, rupture of cargo tanks, and petroleum spills. Vapor recovery systems require the enclosure of highly volatile gases that are normally vented to the atmosphere, thus increasing the possibility of

attributing emissions from vessels to marine terminals and, in 1982, revoked the regulations.

The revocation was challenged by an environmental group and several states. In January 1984, the U.S. Court of Appeals for the D.C. Circuit upheld EPA's repeal of the regulations for vessel emissions occurring in transit to and from the facility. However, the court ordered the agency to reconsider its position with respect to vessel emissions occurring when the vessel was docked and directed EPA to determine what vessel emissions, if any, could logically be attributed to the shore terminal facility.

According to EPA program officials, the agency has not completed the study needed for it to make a determination because of other higher priority matters. An EPA official told us that until the determination is made, EPA is requiring states to show, in any revision to their state implementation plans, that they considered including vessel emissions with those of proposed new or modified facilities or that vessel emissions are insignificant for the particular area.

Since 1981, EPA has not taken any further actions to impose controls on vessel emissions, although regional officials have encouraged the states of California and Texas to include such controls in their implementation plans. Nevertheless, EPA recognizes that there are some sources contributing to ozone formation—marine vessels, among them—that states find difficult to control without federal leadership on control technology. In November 1987, as part of a proposed national ozone strategy to address the likelihood that many areas in the country would not attain the national standard by the December 1987 deadline, EPA outlined several forms of additional federal support to the states. Under this proposal, EPA might assist the states by prescribing specific control measures or by providing technical information on control systems. As of September 1988, EPA was evaluating public comments on the proposal and plans to publish the final policy in late 1988 or early 1989.

## State and Local Efforts to Control Vessel Emissions

State and local air quality agencies' efforts to control marine vessel emissions have been limited. Information obtained from EPA and the Coast Guard indicates that at least 12 states, which include 15 of the nation's 20 largest ports, have considered controlling vessel emissions. However, according to Coast Guard, industry, and local pollution control officials, they have not done so. Among the reasons cited by the states for deferring implementing vessel emission controls were concerns about

the impact of controls on safety and cost and that implementing controls might place ports in their states at a competitive disadvantage vis-a-vis ports in states without emission control requirements. Some vessel operators were also concerned that if states and localities adopted differing requirements, they would be restricted in their ability to service different ports, or they would be required to have, at great cost, a variety of equipment on board to enable them to meet the various requirements.

One state, New Jersey, may have vessel emission controls for loading barges and tankships with gasoline within the next couple of years. In its SIP, New Jersey included a provision to control marine vessel emissions as an extraordinary measure if it failed to meet the December 1987 deadline for achieving the ozone standard. Because New Jersey did not meet that deadline, it now plans to implement vessel emission controls by February 1990.

In discussions with Coast Guard, industry, and local air pollution control district officials, we were informed that the Santa Barbara, California, Air Pollution Control District is the only one that requires that hydrocarbon emissions be captured during vessel loading operations. The regulation, adopted by the district in December 1985, requires owners or operators of marine terminals or tank vessels to reduce hydrocarbon emissions during loading by 95 percent. A self-contained vapor recovery system has been installed on a barge that serves a district terminal and a vapor recovery system is under construction at another terminal in the district.[1] According to a representative of the company that operates the barge, however, the recovery system was installed before the air district requirement, in order to comply with a local ordinance that established hydrocarbon emission requirements for the terminal.

At the beginning of 1986, at least eight states, including New Jersey, were considering vessel emission controls. However, in February 1986, the Secretary of Transportation wrote to these states to ask that they hold their plans in abeyance until a National Research Council study then getting underway could be completed. As discussed later, the study was released in January 1988.

[1]There are three other facilities in California having vessel emission control systems. However, these systems were not required by vessel emission control regulations.

## Efforts to Resolve Safety, Cost, and Commerce Issues

After issues about vessel emission control were raised, EPA, the Coast Guard, MarAd, and at least two states undertook several studies and research projects to address these issues. The issues have not been completely resolved, however.

### EPA Studies

Following EPA's initial proposal to control vessel emissions in Texas, the agency carried out several studies to obtain more information on the hydrocarbon emissions resulting from the loading of crude oil and gasoline into ships and barges. Two of these were designed to describe the magnitude of vessel hydrocarbon emissions and to identify possible methods for controlling them. The reports on these two studies also discussed safety problems associated with vessel control systems and control costs. The earlier report, published in 1976, estimated that the cost of controls ranged from $2,000 to $9,500 a ton of hydrocarbons, depending on the type of safety equipment, but added that until safety problems were completely resolved, costs would be inadequately defined.

In 1977, concerned about its ability to estimate vessel hydrocarbon emissions on a national and regional basis, EPA collected information from eight major oil companies and used the data to develop emission levels for different types of activities in different locations. The study resulted in a December 1978 publication of emission factors that could be used to calculate the need for controls.

In addition, in 1979 EPA planned to demonstrate a safe, cost-effective method of controlling gasoline vapors emitted during barge loading operations. After reviewing four potential control technology methods—refrigeration, carbon adsorption, oil absorption, and incineration—and their safety, costs, and performance, EPA selected the incineration and oil absorption methods for the demonstration. Before the demonstration was started, however, EPA's budget was reduced and the project was curtailed before the system was tested, although the equipment was installed at one facility. The project report, issued in August 1984, concluded, among other things, that (1) selection of a particular vapor control technique was dependent primarily on site-specific conditions and (2) systems where long vapor lines are required, active safety systems—vapor saturation or dilution— should be strongly considered. The report recommended that if vapor control at barge loading facilities is desired by EPA, then conducting the field demonstration would be valuable for obtaining data for safety and economic analyses.

EPA has not undertaken any research projects relative to vessel emission control technology following the barge demonstration project. Since 1981, the agency's efforts have been limited to (1) carrying out two studies to obtain information for responding to the 1984 Court of Appeals decision and (2) participating in recent Coast Guard efforts to assess the feasibility, safety, and cost of vessel emission control systems and develop safety standards for those systems.

## Coast Guard Research and Regulatory Efforts

Because of its responsibility for vessel and port safety, the Coast Guard worked with EPA to develop emission control regulations for the Houston-Galveston area. Although EPA's proposed regulations related only to the Texas ports, the Coast Guard was concerned that requirements for vapor controls might be extended to other areas. Consequently, in 1976, the Coast Guard proposed to issue regulations on safety equipment standards for vapor recovery systems and operational requirements for equipment during vessel loading and unloading. In publishing its proposal, the Coast Guard asked for comments on the use of vapor recovery equipment and associated safety hazards and requirements that should be imposed concerning the equipment. While some of the respondents questioned the need for vapor controls and others were concerned over the cost, all of those responding, according to a Coast Guard official, were concerned about whether such systems were safe.

Also during the late 1970s, the Coast Guard sponsored several research projects and other information-gathering activities aimed at reducing safety hazards. These projects and activities included the development and testing of flame and detonation arrestors for vapor recovery systems and testing to obtain information on cargo tank pressurization changes. The Coast Guard also held a workshop for industry and other government officials to discuss the results of its research. From these efforts, the Coast Guard concluded that through good design practices and the use of commercially available flame arresting devices, these hazards could be overcome. It also concluded that additional research and testing of large-scale flame arresting devices, of the size that could be used in actual loading operations, needed to be done.

The Coast Guard then joined in the ongoing EPA demonstration project to obtain safety information on a full-scale system to recover vapors but discontinued its efforts when EPA terminated its funding for the demonstration portion of the project.

According to a Coast Guard official, the Coast Guard's work on safety issues, including its development of safety standards, came to a halt in 1981. In addition to EPA's curtailing the demonstration project, the Coast Guard official said that neither EPA nor the states appeared to have any further interest in adopting emission controls.

The issue of emission controls surfaced again in 1984, when the Department of Transportation's Towing Safety Advisory Committee called to the Coast Guard's attention the fact that some states and localities were proposing to develop their own vessel emission control requirements. As a result, in 1985, the Coast Guard asked the National Research Council's Marine Board to assess the technical, safety, and economic impacts of vessel emission control systems, including the effect of an absence of uniform state standards.

In the meantime, in late 1987, the Coast Guard's Chemical Transportation Advisory Committee began developing safety regulations for vapor control systems and personnel training and qualification requirements. The committee has completed an interim set of regulations, which the Coast Guard is now evaluating. The Coast Guard expects to issue final regulations by February 1990. The Secretary of Transportation has also repeated the Department's request that the eight states delay implementing any vessel emission controls until the Coast Guard has issued its safety regulations.

## National Research Council Study

Intended to answer a broad range of questions, the study conducted by the National Research Council's Marine Board observed in a report released in January 1988 that hydrocarbon emission control is feasible with available technology. The study, however, did not reach firm conclusions about the safety of these systems. Observing that handling the potentially explosive vapors could present an added hazard, the study panel judged the experience to date too limited to justify firm safety conclusions. The study panel suggested, however, that proper personnel training and management could keep the risks of vapor control within the bounds of normal risks to the industry.

The study panel further found that while the economic impact of vapor control could be substantial, more detailed study was necessary to gauge the sizes of these economic impacts. Terminals handling a low volume of products, inland barges, and smaller, older tankships would face greater impacts than larger units of the industry and consequently could be placed at a competitive disadvantage. With respect to competition, the

study observed that it had been suggested that implementing controls only in nonattainment areas would lead many vessels to areas where controls are not required or are less stringent. The panel also pointed out that neither the Coast Guard nor EPA had taken a major initiative to coordinate or standardize state regulatory development and that without such coordination a high potential exists for a clash of regulatory interests between marine safety and air quality goals.

To address these issues, the panel recommended, among other things, that the Coast Guard revise its certification requirement for tankermen to ensure they are fully qualified and trained to maintain the safety of vapor control operations and that, in the absence of historical safety experience, the Coast Guard employ risk analysis to assess the safety emission control alternatives. The study also recommended that the Coast Guard lead in developing and implementing a coordinated program (involving EPA and the Coast Guard) to ensure the safety and standardization of maritime hydrocarbon vapor emission controls.

With respect to industry's influence on the study, we found that the National Research Council followed its established procedures to minimize potential bias in its work. The emission control study was carried out by an ad hoc committee whose members were nominated by the Marine Board and approved by the National Research Council Chairman. The committee included one Board member to ensure that it adhered to Marine Board and National Research Council policies and standards.

According to the committee staff director, committee members were selected to provide balance among different viewpoints and to obtain necessary expertise. Of the nine members assembled for this study, four worked for the maritime or petroleum industry, one worked for state government, one was a consultant in risk analysis, one was a university professor, one was a research engineer with a major motor vehicle manufacturer and one, the chairman, was a retired Coast Guard officer and also a member of the Marine Board. The staff director also stated that members had to submit a confidential financial statement to the Board and, at the initial committee meeting, had to declare before the committee any views they have had on the subject. In this way, all committee members were expected to be made aware of any biases of the other members.

In carrying out its work, the committee obtained its information—such as listings of terminal operators and cost analyses—from a variety of

sources, including companies, industry associations, and state governments. In one case, it did not rely on industry data but commissioned an independent study to estimate the capital and operating and maintenance costs of vapor control systems.

## Maritime Administration Concerns and Activities

In response to EPA's proposal for regulating vessel emissions at Texas ports, MarAd expressed concern over the technological, safety, and economic issues associated with the design and development of recovery systems and urged that EPA delay implementing any related regulations. MarAd raised another concern when the state of California proposed a rule that its air quality control districts could adopt to control stack gas and vapor emissions from merchant ships. In a December 1978 letter to the Chairman of the California Air Resources Board, MarAd stated that it was opposed to the imposition by any one state of nonuniform rules requiring significant, unique changes in shipboard equipment and operating procedures. MarAd viewed this as an intrusion into federal regulation of shipping and interstate commerce.

MarAd then became concerned that there might be a proliferation of divergent and possibly ill-considered state and local regulations. MarAd saw federal preemption as the solution, and in June 1981, offered to submit to EPA a legislative proposal to amend the Clean Air Act.

MarAd and the Coast Guard together developed such a proposal and submitted it to EPA in April 1982 and again in March 1987, when they asked EPA to review the amendments previously submitted and provide comments. Under this proposal, EPA would be responsible for setting and enforcing emission requirements, while the Coast Guard would be responsible for establishing and enforcing safety regulations. The proposal also required EPA and the Secretary of Transportation to conduct a study of vessel emissions to determine the effect of emissions on air quality, the technological feasibility of controlling such emissions, and the economic effect of controlling emissions. The study was to be completed before any regulations would be issued.

EPA replied that because a number of areas may not meet the 1987 deadline for meeting the ozone standard, the Congress was considering a number of actions that might require amendments to the act. Accordingly, EPA said it was not prepared to recommend specific legislation on marine vessel emissions alone, but it would consider the proposal in the context of other proposed amendments. As noted earlier, although EPA's

proposed national ozone strategy would leave responsibilities for controlling ozone with the states, EPA is evaluating the need for additional federal support.

In addition to the legislative proposals, MarAd also sponsored a study by the Port of Long Beach, California, to help determine vessel emission levels. According to a December 1986 study report, a computer model was developed to calculate vessel air pollution emissions under various scenarios. Among other things, the model is supposed to calculate hydrocarbon emissions released during loading, ballasting, and lightering and, according to the report, the model can be easily adapted to any port by using port-specific data on vessel movements and berth pathways. However, according to EPA and Coast Guard staff, the model is of limited utility.

## State Studies

Studies conducted by California and Texas have addressed some of the issues surrounding vessel emission controls. In 1984, the California Air Resources Board issued a report on the control of vessel emissions. Among other things, the report discussed the controls' competitive impact on U.S. flag vessels and California ports and the impact on vessel and personnel safety. The study concluded that the control of hydrocarbon emissions from vessel loadings would be especially desirable because of their magnitude; however, the control of such emissions for most petroleum loading operations did not appear as an attractive control strategy in terms of cost-effectiveness. The study also concluded that vapor transfer systems that ensure the safety of the vessels and terminals during loading required further investigation. Consequently, the study concluded that the control of vessel loading emissions be deferred pending further investigation.

The Texas Clean Air Study Committee also considered the regulation of vessel emissions and issued a report in 1986. Among other things, the study concluded that many uncertainties remained regarding the extent of vessel emissions and the effectiveness and safety of equipment and procedures to reduce these emissions, and that development or implementation of emission standards for marine vessels must await the completion of the National Research Council study and Coast Guard regulations that were discussed earlier. The study also recommended that the state legislature forward to the U.S. Congress a resolution supporting national reviews and action to establish consistent and appropriate control requirements.

## Conclusions

Vessel emission controls have been considered for many years and at all levels of government. Nevertheless, questions about the safety and cost of vessel emission controls and their effects on interstate commerce have not been fully resolved. Only the issue of availability of technology has been settled, by the development and operation of control equipment on commercial vessels and terminals.

For those issues remaining, the lack of resolution seemingly has as much to do with the degree of interest in regulating emissions as with the technical complexity of the questions. The Coast Guard only carried on safety research for a few years, until 1981, and then did not resume its work until recently, when states began to show interest in regulating vessel emissions. EPA also discontinued its research in 1981 and has only conducted court ordered studies since then. However, the Coast Guard's current work to develop safety standards suggests that safety issues may be closer to resolution. EPA's proposed national ozone strategy may also lessen some state concerns if they provide technical standards and other forms of guidance to states that are interested in adopting control measures.

As for the cost and commerce issues, much seems to depend on whether and how EPA and the states decide to implement vessel emission controls. Coast Guard standards would establish a certain uniformity that might reduce some of the concerns about differing state requirements. If EPA also decides to implement national standards, this may further allay concerns. However, as the National Research Council study points out, the economic effects of vapor emission controls, including effects on competition, still await more detailed study. On the whole, however, the current interest on the part of states in controlling vessel emissions, in combination with the Coast Guard's and EPA's renewed attempts to support regulation, suggests that the issues remaining may be resolved in the near future. For this reason, we are not making recommendations at this time.

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